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FOREST INSECT CONDITIONS IN 1957

A Status Report



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U.S. DEPARTMENT OF AGRICULTURE
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A STATUS REPORT ON FOREST INSECT CONDITIONS IN 1957 ^{1/}

Compiled by
Division of Forest Insect Research

STATUS IN BRIEF

There was a marked increase in the severity and extent of forest insect infestations in the United States during 1957. The increased activity was most pronounced in the coniferous forests of the West but epidemic infestations also occurred in the Northeast, the Lake States, and the South. To the extent possible, epidemic populations of the pest species were suppressed by Federal, State, and private land-owners and land-managers in a concerted effort to reduce tree-damage and tree-killing in affected areas. Although the intensity of infestation of a few major pest species were reduced by control action, and some others declined as a result of natural control factors, other species which heretofore had been quiescent erupted to outbreak proportions.

CONDITIONS IN OREGON AND WASHINGTON

The extent and severity of infestations in Oregon and Washington increased in 1957 after three years of successive decline and thirteen species of destructive pests occurred as outbreaks on a total of 2,129,440 acres. Infestations of the balsam woolly aphid, Chermes piceae (Ratz.), the Engelmann spruce beetle, Dendroctonus engelmanni Hopk., the larch bud moth, Zeiraphera griseana (Hubner), the spruce budworm, Choristoneura fumiferana (Clem), and the western pine beetle, D. brevicornis Lec. increased in severity and extent, and the black-headed budworm, Accleris variana (Fern.), two species of silver fir beetles, Pseudohylesinus spp. and the spruce bud moth, Zeiraphera ratzeburgiana Sax. reappeared in outbreak proportions in several areas.

^{1/} This report is a compilation of information on the status of forest insects submitted by the Forest Experiment Stations, the Federal land-managing agencies, state forestry and conservation organizations, lumber companies, timber operators, private land-owners, and other individuals.

CONDITIONS IN CALIFORNIA

In California, destructive insects also showed a marked increase in extent and severity. Critical epidemics of western pine beetle, Dendroctonus brevicornis Lec., and mountain pine beetle, D. monticolae Hopk., occurred state-wide, particularly in proximity to areas which had been burned in 1955. The Jeffrey pine beetle, D. jeffreyi Hopk., occurred in outbreak numbers in several places and the lodgepole needle-miner, Recurvaria milleri Busck., persisted at epidemic levels in the lodgepole pine stands at Yosemite National Park. The California flat-headed borer, Melanophila californica Van Dyke, continued to cause severe tree-killing in the southern part of the State and the trend of infestations by the Douglas-fir beetle, D. pseudotsugae (Hopk.) was upward in northwestern California. The red turpentine beetle, D. valens Lec., was unusually abundant in association with other bark beetles which had attacked and killed ponderosa and sugar pines, and several species of cone and seed insects were particularly destructive to the coniferous cone crop. Several other species of miscellaneous insects caused serious damage to the forest resources in many areas.

CONDITIONS IN THE ROCKY MOUNTAINS

The coniferous forests in the northern and southern Rocky Mountains were severely affected by several species of destructive bark beetles and tree defoliators. Bark beetles, such as the mountain pine beetle, Dendroctonus monticolae Hopk., the Black Hills beetle, D. ponderosae Hopk., and the Engelmann spruce beetle, D. engelmanni Hopk., caused severe tree-killing in some stands and fir engraver beetles, including Scolytus and Dryocoetes spp., as well as D. pseudotsugae (Hopk.) occurred in outbreak status in several of the fir forests in the Region. The spruce budworm, Choristoneura fumiferana (Clem.), was abundant over extensive areas in Montana and in parts of Idaho and several other defoliators, including such species as Epinotia meritana Hein., Acleria variana (Fern.), Semiothisa sexmaculata (Pack), Anoplonyx occidens, Roh., and others, were epidemic in many places. Of particular importance was the occurrence of an extensive infestation of spruce spider mite, Oligonychus ununguis (Jac.) on some 800,000 acres of fir forests in Montana and southern Idaho. This forest pest occurred in epidemic status principally within the areas which had been sprayed with a formulated DDT insecticide for control of the spruce budworm in 1956.

CONDITIONS IN LAKE STATES, CENTRAL STATES AND NORTHEAST

An increase in scope and severity of several important insects occurred in the Central States, the Lake States and the Northeast. The spruce budworm, Choristoneura fumiferana (Clem.), developed to epidemic proportions on some 300,000 acres in Maine and approximately 666,000

acres of susceptible forest type was heavily defoliated in Minnesota. Populations of Jack-pine budworm, C. pinus Free. declined in most of the Lake States region and there was little evidence of severe defoliation by the forest tent caterpillar, Malacosoma disstria Hbn. The European pine shoot moth, Rhyacionia buoliana (Schiff.) increased in severity in the Lake States and Central States territory and the white-pine weevil, Pissodes strobi (Peck) continued to cause severe damage to white pine and Jack pine in many areas throughout the regions.

CONDITIONS IN SOUTHERN AND SOUTHEASTERN STATES

Most of the important forest insects in the southern and southeastern states were less destructive during 1957 than has been the case for the past several years. Large-scale control projects and low temperatures during December reduced infestations of southern pine beetle, Dendroctonus frontalis Zimm., and increased precipitation benefiting tree-vigor resulted in less damage caused by the Ips engraver beetles and the black turpentine beetle, D. terebrans Oliv. A few defoliating insects occurred in epidemic status in some areas but severe tree-killing did not occur.

CONDITIONS IN ALASKA

Forest insect activity in most areas in Alaska was at a low level. The infestation of hemlock sawfly, Neodiprion tsugae Midd. which occurred in outbreak proportions in scattered locations in 1956 subsided completely and the Ips interpunctus Eichh. outbreak in white spruce north of Fort Yukon declined sharply. An undetermined defoliator caused moderate damage to birch stands in the vicinity of Fairbanks and localized flare-ups of the Alaska spruce beetle, Dendroctonus borealis Hopk. occurred in white spruce on the Kenai Peninsula. The sitka spruce beetle, D. obesus (Mann), was evident only at scattered points in the vicinity of Prince William Sound.

STATUS OF MAJOR INSECT PESTS

MOUNTAIN PINE BEETLE, Dendroctonus monticolae Hopk. The Mountain pine beetle is a serious pest of several species of pines in the western United States and outbreaks of severe proportions were reported from many areas during the year. The scope and severity of infestations was greatest in the lodgepole pine forests in the Intermountain States, in the Northern Rockies, and the Pacific Northwest.

Outbreaks which resulted in the killing of large groups of lodgepole pines were particularly prevalent throughout the Intermountain States, and infestations of severe proportions were reported from the Grand Teton National Park, and on or adjacent to the Teton, Sawtooth, Ashley and Targhee National Forests in Idaho. In Utah, an extensive infestation occurs on the Wasatch National Forest and systematic surveys in this area has revealed that approximately 123,000 infested trees occur on less than 100,000 acres. Outbreaks were also reported on the Ashley National Forest in Utah and in seven new infestation centers, group killings range between 50 and 7,000 trees at each location. In Montana, one outbreak of serious proportions was reported at Glacier National Park. There were 122 separate infestation centers recorded in Oregon and Washington with heaviest concentrations of losses on the Deschutes National Forest and the Klamath Indian Reservation. Epidemic centers on a portion of the Shoshone National Forest in Wyoming continued despite concerted efforts made during the year to reduce infestations by direct means. The high level of losses also continued in the Delaney and Dingley Creek drainages at Yosemite National Park in California due in part, at least, to stand weakening as a result of tree defoliation by the lodgepole needleminer, Recurvaria milleri Busck.

The five-needle pines, namely sugar pine and western white pine also were severely affected by the mountain pine beetle in several of the western states. In California, losses in mature sugar pine increased statewide with centers of infestations in proximity to forested areas on the Sequoia, Klamath, Stanislaus, and Plumas National Forests which were accidentally burned in disastrous fires during 1955. In Oregon, one center of infestation was reported on the Rogue River National Forest. Stands of western white pine were severely damaged on the Gifford Pinchot National Forest in Washington and infestations there covered a total of 55,840 acres. Some 24,320 acres were affected on the Willamette National Forest in Oregon and the beetle was found to be active on three separate areas on the Clearwater National Forest in Idaho.

The killing of ponderosa pine was not reported from extensive areas although the acute infestation on 4,000 acres at Crystal Bay, Nevada

is active and poses a threat to the high value recreational and summer-home areas at the north end of Lake Tahoe. Another infestation on some 3,360 acres where moderate to heavy tree mortality occurred, was reported on and adjacent to the Malheur National Forest in Oregon.

WESTERN PINE BEETLE, Dendroctonus brevicomis Lec. - The western pine beetle, long recognized as the most important natural enemy of ponderosa pine in the western United States, has been endemic in all stands for the past several years. During 1957, however, it was noticed that populations were on the increase and serious tree-killing occurred at several places in the Pacific Coast states. In California, tree-killing was severe on portions of the Sierra, Sequoia, Plumas, Stanislaus, Tahoe, Mendocino and Klamath National Forests as well as at Sequoia-Kings Canyon and Yosemite National Park. Two particularly serious epidemics occurred in the vicinity of areas which had been burned during 1955. These outbreak areas, encompassing some 173,000 acres, suffered losses of several thousands of trees and required emergency programming for control. Severity of infestations also increased in Oregon and Washington and damage occurred to pine stands on an estimated 41,760 acres. Heaviest tree-killing was found on the Fremont National Forest and the Warm Springs Indian Reservation in Oregon, and on the Okanogan National Forest in Washington. These latter infestations were not precipitated by populations arising from damaged timber in burned areas. Low endemic populations and relatively little tree-killing was the rule throughout the remainder of the range of this insect in the Intermountain and northern Rocky Mountain states.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae Hopk. - With minor exceptions, infestations of Douglas-fir beetle have declined to low endemic levels in all of the extensive fir forests of the western states. In Oregon and Washington, outbreak conditions currently were reported on a gross area of 18,400 acres, down from a peak of over 5,000,000 acres infested in 1954. One small outbreak on the Colville Indian Reservation in Washington covered 7,000 acres and two smaller infestations were reported from western Oregon. In California, the rate of losses were reported at a very low level except for local areas on the Klamath and Six Rivers National Forests in proximity to previous epidemics.

In the Northern and Southern Rockies, and elsewhere in the Intermountain States, outbreak conditions were reported from only a few areas. In southern Utah, where the fir type occurs in patches, all of the stands were heavily infested. Other outbreaks were noted in the Yellowstone River Canyon in Yellowstone National Park, and in a few places on the Boise and Sawtooth National Forests in Idaho. In the Southwest, where stands have been subjected to deficiencies in annual precipitation for the past several years, the rate of decline in infestations was less noticeable. It is estimated, for example that some 96 million board feet of timber was killed by the bark beetles on some 820,000 acres in

parts of Arizona and New Mexico with concentrations of tree-killing most pronounced on portions of the Gila and Santa Fe National Forests, and on the Jicarilla Apache Indian Reservation. A similar situation was reported on the San Juan, Grand Mesa-Uncompahgre, Rio Grande, and San Isabel National Forests in southern Colorado.

ENGELMANN SPRUCE BEETLE, Dendroctonus engelmanni Hopk. - This tree-killing bark beetle which was epidemic over extensive forested areas in the northern and southern Rocky Mountains only a few years ago has declined to endemic levels in most areas. Infestations in Colorado, New Mexico, Idaho and Montana are active in only a few local areas, and none of them are of sufficient size to require more than limited action in suppressive measures for their control. An outbreak first discovered in 1955 on the Bridger National Forest in Utah, however, is still aggressive. The infestation covers a gross area of 24,000 acres and it is estimated that as many as 37,000 trees and stumps are infested. Suppressive measures in this latter area have been initiated for control and mop-up operations are being continued in the infested areas in Montana, Idaho, and Colorado.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi Hopk. - This insect pest is not known to attack any host other than Jeffrey pine, hence its occurrence is restricted to the limited range of this tree species in California. The periodicity of outbreaks of the insect is unpredictable and in spite of relatively light populations during the past several years, epidemics were recorded on some 105,000 acres in 1957. Centers of infestations occurred on the Plumas, Sierra and Inyo National Forests in central California and to a lesser degree in the southern portion of the State.

BLACK HILLS BEETLE, Dendroctonus ponderosae Hopk. - The Black Hills beetle, one of the most important insect pests affecting ponderosa pine in the Rocky Mountains and the Black Hills, was reported in epidemic status at several locations. The outbreak on the Dixie National Forest and at Bryce Canyon National Park in southern Utah is now in its eighth year and despite logging and direct chemical treatment of infested trees, epidemic centers of infestations continue to develop in adjacent stands. Infestations are reported to have increased also on the Carson National Forest in northern New Mexico; on the Pike, Roosevelt and San Isabel National Forests in southern Colorado; and to some degree in the Black Hills of South Dakota. Artificial measures for control are planned in all of these outbreak areas.

SOUTHWESTERN PINE BEETLE, Dendroctonus barberi Hopk. - This insect, usually found in association with other bark beetle species in the ponderosa pine stands of the Southwest, was quite prevalent over large areas in parts of New Mexico, Arizona and southern Nevada during 1957. A complex of species, including D. barberi Hopk., D. approximatus, Dietz.,

Ips lecontei Sw. and Ips ponderosae Sw. were associated in recently killed pines on some 1,711,000 acres in Arizona and New Mexico. The initial attack on trees usually was by I. lecontei Sw. followed by D. barberi Hopk. in the basal portion of the stem. D. approximatus Dietz, and I. ponderosae Sw. occurred occasionally in conjunction with the other species. An infestation of D. barberi Hopk. without the associated species continued in epidemic status at Charleston Mountain in Nevada and in this area, concerted efforts are being made to reduce the high rate of tree-killing by spraying infested trees with toxic oils. D. convexifrons Hopk. occurred in outbreak status in a limited area on Mt. Graham, southwest of Safford, Arizona. It was not abundant, however, in any other area.

SITKA SPRUCE BEETLE, Dendroctonus obesus (Mann.) - The Sitka spruce beetle has been prevalent in white spruce stands at several locations in Alaska for the past several years but currently the insect is reported to be confined to relatively small areas on Prince William Sound. The largest of the infestations now known is at Blackstone Bay near Whittier but this situation is not viewed with alarm as populations appear to be on a downward trend.

ALASKA SPRUCE BEETLE, Dendroctonus borealis Hopk. - The rate of tree-killing in stands of white spruce caused by this insect pest changed little from conditions which have existed in Alaska during the past several years. Scattered group losses were reported again on the Kenai Peninsula and south of the Alaska Range but the rate of tree-killing is not excessive.

SILVER FIR BEETLES, Pseudohylesinus spp. - The Pseudohylesinus beetles which were quite destructive to stands of Pacific silver fir in Oregon and Washington during the years 1947-1954, declined in numbers abruptly in 1955 and practically disappeared during 1956. However, these destructive pests were reported again in 1957, at five separate infestation centers on the Mt. Baker and Snoqualmie National Forests in Washington, indicating a possible resurgence of damaging populations.

WESTERN BALSAM BARK BEETLE, Dryocoetes confusus Sw. - The status of this insect changed very little during the year and epidemic infestations were reported only on the Carson and Santa Fe National Forests in northern New Mexico and within the Roaring River drainage on the Boise National Forest in Idaho. In southern Utah, and elsewhere in the Intermountain states, intensity and scope of infestations appear to have decreased.

BLACK TURPENTINE BEETLE, Dendroctonus terebrans Oliv. - The severity of losses caused by the black turpentine beetle in pine stands of the southern and southeastern states was somewhat less in 1957 than during previous years. Infestations which have required suppressive measures

for control in Georgia and Florida were reported to be endemic and only scattered tree-killing occurred elsewhere in the two states. Two small outbreak areas were noted in North Carolina but chemical treatment of infested trees controlled them. In the southern states, many of the pine tracts on flooded sites, in some cutting areas, and in stands damaged by wildfires, were attacked but prompt control in all areas reduced populations to low endemic levels.

SOUTHERN PINE BEETLE, Dendroctonus frontalis Zimm. The rate of tree-killing caused by the southern pine beetle in all of the southern and southeastern states currently was somewhat less than has been the case for the past several years. In the Southeast, beetle activity appeared to be centered in an 8,000 square mile area in western North Carolina, eastern Tennessee, northeastern Georgia and northwestern South Carolina. Light infestations, however, were reported along the South Carolina coast and in central and eastern Virginia. For the first time in possibly 40 years, the insect was discovered in portions of Louisiana and new infestations of minor proportions occurred in east Texas, the first recurrence in that area since the last major outbreak terminated in 1951. Elsewhere in the South, tree-killing was at or below levels of prior years. It is of interest that low temperatures during the winter months killed a large percentage of the beetle broods throughout the Appalachian Mountains and this, combined with concerted efforts to suppress populations by direct means during the course of the year, may result in a termination of the long-standing epidemic in this area. Prompt action, of course was taken to suppress the new infestations in Louisiana and east Texas, and maintenance control is being continued where the beetle is active in Mississippi and Alabama.

FIR ENGRAVER, Scolytus ventralis Lec. - The true fir stands in several of the western states were severely affected in 1957 by this scolytid beetle. The long-standing outbreak in stands of white fir on the Sandia Mountains east of Albuquerque, New Mexico continued at or above the level occurring in prior years and it is estimated that some 7,900 trees were killed during the year. Considerable tree-killing also occurred in southern Utah on and near Bryce Canyon National Park in stands of white fir weakened as a result of defoliation by Epinotia meritana Hein. Infestations covering 21,800 acres occurred in the alpine fir type in the Cascade Range in Oregon and on smaller areas in red and white fir stands on the Stanislaus and Sequoia National Forests in California.

PINE ENGRAVER BEETLES, Ips spp. - The extent and severity of tree-killing caused by the several species of pine engraver beetles in the various sections of the country is unpredictable from year to year due to wide fluctuations in populations resulting from changes in climatic conditions affecting broods and vigor of host trees. Damage to pine stands in

California was reported at a low level except for localized outbreaks of I. confusus Lec. and I. oregoni (Eichh.) at low elevations in the northern Sierras and in parts of southern California. The latter species also was reported in outbreak status on some 28,000 acres in the Blue Mountains of Oregon, and on portions of the Rogue River and Mt. Hood National Forests, but these infestations are much reduced from conditions which occurred last year.

In the Southwest, two Ips species, I. lecontei Sw., and I. ponderosae Hopk. were found in association with one or more Dendroctonus beetles in recently killed ponderosa pine on about 1 3/4 million acres. In most instances, I. lecontei Sw. was found to have initiated attack in the top portion of the trees and this discovery indicates the species to be of primary, rather than secondary importance in the losses sustained in the pine stands of Arizona and New Mexico. The insect also was found attacking and killing pinyon pines over extensive areas in Arizona, New Mexico, southern Utah, and western Nevada, another indication that the insect is a primary forest pest.

The widespread infestations of I. interpunctus Eichh. which caused heavy losses in stands of white spruce in Alaska in recent years was reported to have subsided during 1957 and it is expected that only light scattered infestations will be found during 1958.

In the Southeast, outbreaks of I. calligraphus Germ., I. grandicollis Eichh., and I. avulsus Eichh., were extensive and very destructive in the east-central portions of Virginia and North Carolina, and in northeastern South Carolina during the summer months but adverse factors of one type or another caused the infestations to collapse suddenly in late August and early September. The severe 1956 outbreaks of these latter species in east Texas, Oklahoma, and Arkansas also declined abruptly in 1957. Heavy rains in these areas during the spring months presumably increased the vigor of the host trees and made them less vulnerable to attack. Whatever the reason, by midyear, Ips populations in the southern states appeared to be confined to trees struck by lightning, or those severely weakened by other causes. In southern Ohio and central Missouri, Ips beetles were reported in several red pine plantations of from 5 to 100 acres in size.

PINE REPRODUCTION WEEVILS, Hylobius, Pachylobius, Pissodes, and Cylindrocoptorus spp. Several species of weevils which are destructive to young pines in plantations and in natural stands were abundant during the year. The white-pine weevil, Pissodes strobi (Peck), was prevalent again in white-pine in most of the New England and Northeastern states and high percentages of planted pines were attacked in many areas. The insect also was abundant on jack, red, Scotch and Austrian pine in the Lake States. In the latter areas, as much as 40 percent of the trees in some plantations were attacked

and infestations on red pines were reported as severe in several areas in Michigan and Wisconsin. The pales weevil Hylobius pales (Hbst.), and the pitch-eating weevil, Pachylobius picivorus Germ., which have been pests of areas newly planted to pines in the southern states were less of a problem. Damage by these insects can be avoided if 6 to 9 months are allowed to lapse between the time of harvest cuttings and new plantings. Cylindrocoptorus eatoni Buch. continued to cause serious damage to ponderosa and Jeffrey pines in plantations in California and a new center of infestation in that state was detected in an out-planting of hybrid pines on the El Dorado National Forest. An outbreak covering some 400 acres of plantations on the Shasta-Trinity National Forest was controlled during the year by aerial application of DDT.

PINE ROOT-COLLAR WEEVIL, Hylobius radicis Buch. Heavy damage to plantations and natural stands of red pine caused by the pine root-collar weevil was reported in various parts of the Lake States region. Damage was severe to red and Scotch pines planted as windbreaks and shelterbelts in parts of Minnesota and Michigan and in the sandy soil types in northwestern and central Wisconsin.

CALIFORNIA FLATHEADED BORER, Melanophila californica Van Dyke. - This buprestid beetle, a major pest of ponderosa and Jeffrey pine in California, occurred in epidemic proportions at Mt. Laguna on the Cleveland National Forest. On some 7,500 acres in this area, it is estimated that about 2.5 percent of the green stand or approximately 13,000 trees were killed.

CONE AND SEED INSECTS. Insects which attack and destroy the cones and seeds of coniferous trees were reported as serious pests in many sections of the country. In California, where the seed crop was relatively light during 1957, several species caused serious damage. The sugar pine cone beetle, Conophthorus lambertianae Hopk. destroyed an estimated 90 percent of the sugar pine cones; pine seed worms reduced the seed crop of Jeffrey pine seed cones by about 75 percent; and the cones and seeds of ponderosa pine and Douglas-fir were practically wiped out by one or more pest species. Cone moths, Dioryctria spp. and Barbara spp. also were abundant and in conjunction with Megastigmus spp. were destructive statewide. Heavy infestations of Conophthorus beetles were reported affecting cones of red pine in Cass County, Minnesota and slash pine cones in Florida were found to be heavily attacked by Dioryctria moths.

SPRUCE MITE, Oligonychus ununguis (Jac.) A new situation which developed during 1957 was the occurrence of severe infestations of spruce mites in the fir forests of Montana and southern Idaho which had been sprayed with DDT in 1956 for control of spruce budworm, Choristoneura fumiferana (Clem.). Although a few lesser infestations were noted outside sprayed areas, heavy mite populations and tree damage coincided closely with the sprayed areas. The damage in southern Idaho occurred on some 23,300 acres and approximately 790,000 acres were severely affected in Montana. It is of interest that these mite infestations are the first to have occurred in

epidemic proportions in the coniferous forests anywhere in the Nation subsequent to aerial application of DDT sprays for control of tree defoliators.

BALSAM WOOLLY APHID, Chermes piceae (Ratz.) The severity and extent of infestations by this destructive insect pest continued to increase in the fir stands of the Pacific Northwest. First noted in epidemic proportions on Pacific silver fir and subalpine fir in 1954, infestations increased rapidly from some 295,000 acres in 1955 to 599,000 acres in 1957. The largest increase occurred on the Willamette National Forest in Oregon where spread during the year was estimated at 233,000 acres. Heavy tree-killing of severely attacked trees was conspicuous in all epidemic centers and salvage logging has been stepped-up to the extent practicable and feasible in an effort to utilize the dead and dying material prior to its deterioration. Research on the aphid was given high priority in 1957 and an important start was made to investigate the possibilities of biological control by importing a predaceous fly, Aphidoletes thomsoni Mohn., from Europe.

A new infestation, believed to be of recent origin, was discovered on Frazier fir on Mt. Mitchell in North Carolina but its severity and extent is not yet known. Infested trees, however, appear covered with a white, woolly substance, indicating heavy populations unaffected by natural enemies. Status of the woolly aphid in the northeastern states was little changed from conditions of prior years.

SPRUCE BUDWORM, Choristoneura fumiferana (Clem.) - This destructive insect, distributed throughout the range of susceptible host type in the United States, occurred in epidemic status on several million acres in many parts of the country. In Maine, infestations were found on a total of 2,289,000 acres of which 270,000 acres sustained heavy defoliation and 707,000 acres medium defoliation. While the intensity of the infestation on these 979,000 acres constituted a considerable increase over prior years, the over-all extent of the outbreak decreased due to a lower level of populations in the lightly infested areas of 1956. Because of an expected high population and severe tree damage in Aroostook County, and the unlikely prospects that natural factors will exert a controlling influence on the population, aerial application of DDT insecticide on some 300,000 acres is planned for 1958. Infestations in Minnesota also increased and approximately 660,000 acres of balsam fir were moderately to heavily defoliated. The stands of spruce and fir in much of this area now have suffered from two or more years of heavy larval feeding and it is expected that serious defoliation will occur again in 1958. Budworm populations remained at relatively low levels in Michigan but heavy defoliation was reported in northwestern Wisconsin for the first time in many years.

The spruce budworm has been epidemic in portions of north Idaho and in Montana for the past 10 years and despite aerial spraying for control on more than 2,000,000 acres since 1953, it is estimated that infestations still occur on some 2,846,000 acres. Damage being caused to the fir stands throughout the areas of infestation has been severe and many of the younger understory trees have been killed. There is little evidence to date of any major change in population densities and it can be expected that the infestation will continue in epidemic status during 1958.

In southern Idaho, 512,300 acres were defoliated on portions of Boise, Challis, Payette, Sawtooth, and Salmon National Forests. In New Mexico, the 154,950 acres which are affected represent a decline from conditions which existed in that state the previous year. In Arizona, increased populations at high elevations on the Kaibab National Forest and at Grand Canyon National Park has resulted in severe defoliation and plans have been made to spray some 90,000 acres in that area for control during 1958.

The epidemic that began in Oregon and Washington in 1944 is still in progress and after two years of an apparent decline in intensity, is once again on the increase. Currently, some 830,960 acres are infested on or adjacent to the Malheur, Ochoco, Umatilla and Wallowa-Whitman National Forests in the Blue Mountain region of Oregon and plans have been made to spray this area for control during 1958.

JACK-PINE BUDWORM, Choristoneura pinus Free. - This important insect pest which has occurred in epidemic numbers over relatively large areas in the Lake States region during the past several years declined in all areas in 1957. Infestations in Minnesota disappeared completely in most areas and those in Wisconsin were much reduced from levels of the past few years. A few areas of light defoliation were reported from the Upper Peninsula of Michigan and some stands in the Lower Peninsula were infested to a moderate degree. Adverse weather and a high degree of parasitism are credited as factors causing the decline of the budworm populations.

BLACKHEADED BUDWORM, Acleris variana (Fern.) For the first time in more than a decade, this destructive insect pest occurred in epidemic proportions in Washington. Infestations were found to occur on some 252,800 acres on and adjacent to the Snoqualmie National Forest and Yakima Indian Reservation where western hemlock, Pacific silver fir, Douglas-fir, and grand fir were attacked. Previous epidemics have occurred principally on the Olympia Peninsula and after lasting about two years have subsided rather suddenly without causing significant tree-killing. In Montana, high endemic populations were reported throughout many Douglas-fir stands east of the Continental Divide in conjunction with infestations of the spruce budworm. Epidemic infestations, on a total of 32,000 acres, however, occurred in hemlock stands at scattered locations on the Kootenai National Forest and Glacier National Park in western Montana and on a portion of the Kaniksu

National Forest in northern Idaho. In some of the areas, there was a noticeable reduction in larval population prior to pupation and it is believed that the trend of infestations is downward.

DOUGLAS-FIR TUSSOCK MOTH, Hemerocampa pseudotsugata McD. - At periodic intervals, this important insect pest has occurred in epidemic proportions in the fir forests of most all of the western states. During 1957, a localized outbreak was reported on some 10,000 acres of Douglas-fir second growth in Owyhee County, Idaho and the same species, or a closely related one, became epidemic on approximately 160 acres of white fir in the vicinity of Pinal Mountain near Globe, Arizona. The moth population in Idaho was found to be affected by a virus organism late in the year and the outbreak is expected to collapse without benefit of artificial measures for its control. Aerial spraying of DDT will be undertaken, however, to control the outbreak in Arizona. No new egg masses or other evidence of infestations were to be found in the fir forests of California where the insect had been controlled by aerial spraying in 1956 and no active infestations were reported from Montana.

SPRUCE BUD MOTH, Zeiraphera ratzeburgiana Sax. This insect pest, an accidental introduction in the Pacific Northwest, occurred in epidemic status on Sitka spruce on 52,000 acres along the Oregon and Washington coasts during the year. Areas of heaviest damage was reported to occur on about 34,000 acres on the Siuslaw National Forest.

LARCH BUDMOTH, Zeiraphera griseana (Hbn.). This insect pest, first noted in epidemic status on 33,000 acres in the northern Rocky Mountains in 1955, now occurs on an estimated 250,000 acres in scattered centers in Montana and north Idaho. The outbreak is characterized by a concentration of populations in mature stands of western larch that occur in patches along the summits of ridges and in headwaters of many drainages. Little or no defoliation was noticeable below elevations of 4,200 feet, but above that level, larval feeding was heavy and extended to elevations above 6,000 feet. Outbreaks also were reported from some 39,520 acres on and adjacent to the Okanogan National Forest in Washington. No control is contemplated in any of the infestation areas.

LARCH LOOPER, Semiothisa sexmaculata (Pack). - This defoliating insect was reported from widespread areas in the northern Rocky Mountains and although populations usually were relatively light, heavy infestations were encountered along the Blackfoot River northeast of Bonner, Montana and at a few other locations along the Canadian border. There are no known records of the occurrence of this insect in these areas prior to 1955.

ALPINE FIR DEFOLIATOR. - An unidentified leaf-feeding insect was reported to have defoliated approximately 153,000 acres of alpine fir on and

adjacent to the Boise National Forest in Idaho. This is the second year that defoliation has occurred in this general vicinity and the infestation appears to occur only on areas which had been sprayed for control of spruce budworm. Collections of insects have been made from the affected area but identifications are not yet available.

BIRCH DEFOLIATOR - A Lepidopterous insect, as yet unidentified, was reported in epidemic status on paper birch over a wide area in interior Alaska and observations in the infestation area have indicated that moderate to heavy defoliation can be expected throughout the paper birch stands during 1958.

ASPEN LEAFROLLER. - An unidentified defoliator, believed to be a Choristoneura spp. was reported in outbreak status on some 500 acres of quaking aspen on the Carson National Forest in New Mexico.

SPRUCE MEALYBUG, Puto sp. - Approximately 60,000 acres of Engelmann spruce at two locations on the Dixie and Fishlake National Forests in southern Utah are heavily infested by this unnamed mealybug. Trees of all ages are affected and in areas where the pest has been active for several years, vigor of trees has been materially reduced and many of them are severely deformed. The extent of tree-killing in the area has not been determined but probably occurs only after continued feeding over a period of years. Methods for control of this pest species are not known.

LARCH CASEBEARER, Coleophora laricella (Hbn.). - This European insect which is widely distributed in the eastern United States was found in 1957 for the first time near St. Maries, in northern Idaho. Inasmuch as the infestation occurred on a gross area of some 15,000 acres, this pest insect presumably has been present in stands of western larch for the past several years. Defoliation within the area of infestation was severe and it is to be expected that heavy damage to the host trees will continue during 1958.

PINE BUTTERFLY, Neophasia menapia F.&F. - At periodic intervals this insect pest occurs in outbreak proportions in the pine stands of the western states and because of its destructiveness, special attention is given to detection of incipient infestations. While several localized infestations were discovered on the Boise, Payette, and Salmon National Forests in Idaho, none were of serious consequence.

FIR NEEDLEMINER, Epinotia meritana Hein. - The long-standing outbreak of this needleminer on some 10,000 acres of white fir stands at Bryce Canyon National Park and on the Dixie National Forest in southern Utah is now reported to be endemic. Although the decrease in intensity of the outbreak is attributed primarily to parasites, an aerial spraying program on 4,000 acres also caused a reduction in the pest population. During

the past 10 years, this infestation has caused some killing of trees, principally in the understory, and there has been severe weakening of the stand as a whole. Currently, the weakened stand is highly susceptible to attack by bark beetles and tree-killing by Scolytus ventralis Lec., is reported to be on the increase in the affected area.

LODGEPOLE NEEDLEMINER, Recurvaria milleri Busk. - This important forest pest continued in epidemic status at Toulumne Meadows, Yosemite National Park, California and cumulative defoliation during the past several years is now causing mortality of affected trees. Since 1957 was a flight year for the moth, it is highly likely that new areas of susceptible type were invaded. Efforts thus far to suppress this insect by direct means have not been successful and it is feared that the entire forest stand in affected areas will soon be killed. A closely related species, tentatively identified as a Recurvaria species, increased in severity and extent in the ponderosa pine stands of the Southwestern states. Currently, some 126,000 acres are infested whereas only 50,000 acres were reported in 1956. The new areas of infestations are in the vicinity of El Rito, New Mexico, Williams, Arizona, and Rye, Colorado. Damage in all areas affected previous years' growth and defoliation thus far has not been severe enough to cause tree mortality.

PINE SAWFLIES, Diprion and Neodiprion spp.- Infestations of pine sawflies ranging from a few acres to more than a million acres in size were reported from many sections of the country throughout the year. The largest infestation reported was N. pratti pratti Dyar which extended from an area north of Baltimore to the lower end of the Potomac River in Maryland, a gross area of some 1,500,000 acres. Affected trees were pitch-pine and Virginia pine. The occurrence of other sawfly species on much smaller acreages were as follows: N. lecontei (Fitch) was prevalent in pine plantations in many areas; infestations were severe in parts of Michigan, Wisconsin, Minnesota, and in the southern and southeastern states, particularly in east Texas and west Florida; it was also unusually abundant in New York, western Maryland, and northeastern Ohio; N. pratti paradoxicus Roh. was abundant in southern New Jersey and pitch and shortleaf pines were defoliated over a wide area; N. sertifer (Geoff.) caused severe damage to young hard pines in the Lower Peninsula of Michigan and the species appears to be increasing in severity and extent in southern Connecticut and southeastern New York. Populations in Ohio were variable, lower in some areas and higher in others. A virus organism sprayed into infestations during 1953 and 1955 appears to have materially reduced populations in those areas. D. similis (Htg.) was abundant on white pine in parts of Minnesota and Wisconsin and for the first time it was reported from local areas in southern Michigan; N. excitans Roh. occurred in outbreak status in Arkansas, Texas, Louisiana, Mississippi and in five counties in north-central Florida; N. taedae linearis Ross was abundant in Arkansas, at scattered locations in South Carolina, and

in the northeastern quarter of Missouri and in southern Illinois. Infestations in Missouri were observed at scattered locations over a gross area of 122,000 acres with the heaviest infestation center on shortleaf pine on a portion of the Poplar Bluff Ranger District, Shawnee National Forest; N. nanulus nanulus Schedl and N. Manrus Roh. caused moderate defoliation of jack pine in the vicinity of Bemidji, and in Crow Wing County, Minnesota and N. nanulus was quite noticeable on some 2,000 acres in St. Lawrence County, New York; N. pinetum (Nort.) was also reported to be abundant on white pine in New York and in central Ohio. An unidentified species occurred on about 600 acres of ponderosa pine in the vicinity of Grants, New Mexico but larval feeding was confined to previous years' growth and to date there has been no mortality of affected trees.

SPRUCE AND FIR SAWFLIES, Neodiprion and Diprion spp. - The known status of a few species of sawflies attacking spruce and fir is as follows: N. abietis complex was endemic in stands of Douglas-fir throughout southern Idaho but epidemic at the craters of the Moon National Monument in that state and in Hubbard County, Minnesota; the recent outbreak of N. tsugae Midd. in southeast Alaska collapsed from natural causes and close search of the spruce stands from the air and on the ground failed to reveal new outbreak areas. One small infestation of D. hercyniae (Htg.) was reported on white spruce in northeastern Wisconsin.

LARCH SAWFLY, Pristiphora erichsonii (Htg.) - Heavy defoliation of larch by this sawfly was reported throughout the range of the tree species in the Lake States region. The area of defoliation in Minnesota was about the same as that recorded in 1956, and tree mortality resulting from nine consecutive years of defoliation is becoming quite evident in the north-central part of that state. In Wisconsin, defoliation ranging from heavy to complete occurred over most of the northern half of the state and many stands in the east-central area were infested to varying degree. Infestations and severe defoliation also occurred over much of the Upper and Lower Peninsulas of Michigan. This species, first found in the northern Rockies during 1934, spread throughout western Montana and northern Idaho by 1944. There are no records however, of its occurrence in these areas since that time.

The two-lined larch sawfly, Anoplonyx occidentis Ross. and the western larch sawfly, A. laricivorus Roh. & Midd, however, were reported to have occurred in association with Semiothisa sexmaculata (Pack.) in defoliation of western larch throughout the range of this tree species in Idaho and Montana. Although these two species of sawflies are known to have occurred in epidemic numbers in this general area during 1921 and again in 1938, in each instance the outbreaks subsided the following year and neither insect was recorded again until 1955.

EUROPEAN PINE SHOOT MOTH, Rhyacionia buoliana (Schiff.) - The severity of European pine shoot moth infestations increased materially in the

extensive areas planted to red pine and Scotch pine in the Lake States and Central States region. In Michigan, virtually all of the pine plantations are heavily infested in the Lower Peninsula and the insect is also well established in several counties in the Upper Peninsula. In Wisconsin, there has been a spread of infestations north along Lake Michigan and also to the west in the southern part of the state. The insect also caused serious damage to red pine in southern Connecticut and New York, northern New Jersey, Pennsylvania, Delaware and northern West Virginia.

Two species of other pine tip moths occurred in abundance in the southern, southeastern, northeastern and central states region in 1957. R. frustrana (Comst.) continued at a high level throughout most of the southeast and it was prevalent also in the south and in portions of Ohio. In northern Mississippi, Louisiana, and Texas trees of commercial size were heavily infested and from the air, the red-fringed crown of affected trees resembled group killing by bark beetles. The closely related species, R. rigidana (Fern.) was not as common in any area but it was more abundant than in prior years.

ZIMMERMAN PINE MOTH, Dioryctria zimmermani (Grote). - This pine moth was reported in abundance near LaPorte, Indiana on approximately 800 acres of planted pines. Red, Scotch and pitch pines were affected but Scotch pine was damaged to a greater degree than the other species.

MIMOSA WEBWORM, Homadaula albizziae This insect pest was reported to have caused heavy defoliation of honey locust and mimosa trees at several locations in the vicinity of Indianapolis, Indiana and in southeastern Missouri and in Ohio. Defoliated trees, however, were not killed and the infestations are not expected to continue in outbreak proportions.

SCALE INSECTS - The status of damaging species of scale insects throughout the forested areas of the Nation is not accurately known but several species causing damage in local areas were reported during the year. Small localized infestations of Nuculaspis californicus (Colm.) and Phenacaspis pinifoliae (Fitch) occurred on ponderosa pines in the vicinity of Spokane, Washington as remnants of epidemic populations that were decimated during 1951 and again in 1955 by extremely low winter temperatures. The latter species also was reported throughout Minnesota on several pine hosts. The Prescott scale, Matsucoccus vexillorum Morrison was found in moderate numbers on ponderosa pine at the North Rim, Grand Canyon National Park and on the Prescott National Forest in Arizona but tree-damage was restricted to branch killing in affected areas. Moderate infestations of pine tortoise scale, Toumeyella numismaticum (P&McD.) occurred on Scotch pine in portions of Minnesota, Michigan and Wisconsin, and on Virginia pine in several areas in Maryland, West Virginia, and Pennsylvania. In these latter states, surveys during the summer months revealed that predation by the Coccinellids, Hyperaspis binotata (Say) and H. signata (Oliv), and the Lepidopteron, Lactilia coccidivora, had controlled the

scale in areas where serious infestations were reported. The red pine scale, Matsucoccus resinosae B.&G. is still abundant in some plantations of red pine in the Bridgeport, Connecticut area and on Long Island and in Westchester County, New York.

TENT CATERPILLARS, Malacosoma spp. - The severity and extent of tent caterpillar infestations changed very little in most sections of the country from conditions noted during 1956. While M. disstria (Hbn.) was found in outbreak proportions in northwestern Wisconsin and in the western part of Upper Peninsula in Michigan, tree defoliation in Minnesota was confined to a comparatively small area in south-central St. Louis County. M. fragilis Stretch was abundant and caused heavy defoliation to stands of aspen in parts of Arizona, New Mexico and Colorado but the acreages of infestations were reduced over 1956 and the trend of populations is downward.

GYPSY MOTH, Porthetria dispar (L) - The gypsy moth infestations remained at a low level in New York and most of New England. In Maine and portions of Vermont and New York, low winter temperatures and late spring frosts were apparently responsible for considerable reduction in gypsy moth populations. The large-scale Federal spray program aimed at eradication of this pest in the tri-state area of New York, New Jersey and Pennsylvania covered a gross area of 2,902,517 acres and other cooperative eradication spraying included 102,820 acres in Pennsylvania and 18,880 acres in Michigan. In the latter state, no moths could be found subsequent to spraying and it is possible the insect has now been eradicated in that area.

COOLEY GALL LOUSE, Chermes cooleyi Gill. - High endemic infestations of this insect were reported in stands of Douglas-fir of Christmas tree size in the upper Kootenai River and Tobacco River Valleys in northwestern Montana. The infestations in all instances appeared to be associated with severe infections of a needle blight identified as Rhabdocline pseudotsugae Syd.

SARATOGA SPITTLEBUG, Aphrophora saratogensis (Fitch.). - This forest insect continued to be a major pest in red pine plantations in portions of Wisconsin and the Upper Peninsula of Michigan, and on jack-pine in Minnesota. There was, however, a widespread reduction in nymphal populations in some infested areas during the spring months and artificial measures for control were needed only on approximately 10,000 acres during the year.

TEXAS LEAF-CUTTING ANT, Atta texana Buckley. - This insect is an important pest in portions of Texas and Louisiana and entire plantations of pine seedlings up to 4 years of age often are destroyed within a period of a few days when other green plants are not available to the ants during the winter months. Ant-towns, and resultant defoliation of pines, have become more numerous in recent years in sandy-soil where annual rainfall has been deficient. In areas where ant infestations are prevalent,

fumigation of the soil is a prerequisite to planting.

VARIABLE OAK LEAF CATERPILLAR, Heterocampa manteo (Dblly.) The variable oak leaf caterpillar was reported from only one small area in Warwick County, Virginia during the year in contrast to the outbreak covering several millions of acres in the state in 1956. For reasons not wholly known, there was little or no emergence of adult insects despite the fact that prepupae were abundant in the soil during the winter 1956-1957. Sudden collapse of infestations of this insect is a characteristic of this pest.

ELM SPANWORM, Ennomos subsignarius (Hbn.). - The elm spanworm which has been epidemic in the hardwood stands of northern Georgia for the past two years increased in severity and extent during 1957. The acreage of defoliation, currently estimated on some 100,000 acres in Georgia, also occurs on about 200,000 acres in southeastern Tennessee and in southwestern North Carolina. Heaviest defoliation thus far has occurred on hickory and oak growing along the tops of ridges.

SHORT-TAILED CRICKET, Anurogryllus muticus (DeG.) was discovered as a new pest of germinated pine seedlings in portions of Louisiana, east Texas and Arkansas. The insect was found to sever the stem of the seedling and to consume the tender foliage in its underground tunnel.

FALL CANKERWORM, Alsophila pometaria (Harr.) - A noticeable increase in extent and severity of cankerworm infestations occurred in portions of Maryland and Maine during the spring months. While chestnut oak and associated oak species in the infestation areas were stripped of foliage, little or no feeding was noticed on other tree species in the affected areas.

SADDLED PROMINENT, Heterocampa guttivitta (Wlk.) - The large-scale outbreak of this insect which occurred in portions of New York, Pennsylvania, New Hampshire and New York during 1956 was reported to have collapsed from natural causes. Heavy parasitism to larval brood is believed to have caused the reduction in populations.

PINE LEAF APHID, Pineus pinifoliae (Fitch) - The coniferous galls on red spruce caused by this aphid were particularly abundant in most of the northeastern states, particularly in western Maine, and in New York and Vermont. Another gall-former on spruce, and a tip feeder on white pine, Pineus floccus (Patch) caused exceptionally severe damage to red spruce in Vermont and it was reported frequently from New York also.

FRUIT TREE LEAF ROLLER, Archips argyrospila (Wlkr.). For the second year, the fruit tree leaf roller was epidemic over a large area on the Lower Peninsula of Michigan and infestations of lighter proportions were

reported from northeastern Wisconsin. Heavy parasitism of larval broods occurred in both states, however, and infestations are expected to decline in 1958. Another leaf roller, Sparganothis pettitana Robinson, and a webworm, Tetralopha, caused severe defoliation of sugar maple in portions of Wisconsin and Michigan. Feeding by the two insect species was somewhat lighter than occurred in 1955 and 1956 and with the abundance of predators and parasites noted in 1957, it is expected that the infestations will be materially reduced during 1958.

THE RED-HUMPED OAKWORM, Symmerista albicosta (Hbn.). The red-humped oakworm was reported to have occurred in outbreak status on some 45,000 acres of oak type in several counties in Michigan and trees were severely defoliated in all areas affected. Due to parasitism of larval broods, the outbreak is expected to subside before serious damage or tree mortality occurs.

WHITE GRUBS Phyllophaga spp. Unusually heavy flights of Phyllophaga beetles were reported from Texas and other southern states during the early spring months and subsequently severe damage by grubs occurred to pine seedlings in many areas. In one instance, a million nursery seedlings were reported to have been killed in Arkansas.

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